

here no living organisms have been found. It is purely azoic; the reason for the want of life is, according to the author, the want of oxygen and the abundance of carbonic acid.

There is, in fact, no special deep-sea fauna found in this large tract of water.

Turning to the terrestrial mammalia, the author comes to the conclusion (elaborated in a special and highly interesting chapter) that their range to-day is in thorough agreement with the distribution of land and water. The Mediterranean southwards and the Bosphorus westwards form barriers which divide faunas. This is illustrative of what is apt to be a common error in text-books of zoology. When Mr. Sclater originally divided up the earth into zoological regions, he did not profess to do so for more than the Passerine birds, though his conclusions were shown later by himself and by others to apply to other groups also. They do not, however, in the least apply to various invertebrate groups; and in dogmatically dividing the world into the Sclaterian regions, the writers of some text-books have entirely lost the prime object of such a regional division. The more modern Eutherian mammals are controlled in their range by what are largely existing barriers; the more ancient molluscs show in their distribution the non-existence of such barriers in ancient times. Dr. Kobelt dwells upon the distinctness of northern Africa from Europe so far as concerns its mammalian inhabitants. He is disposed to dismiss the Gibraltar monkey as truly indigenous to that peninsula, though admitting the occurrence of fossil allies in European strata of Pleistocene and Pliocene age.

On the whole, however, we are not certain that Dr. Kobelt has taken so fortunate an instance as he might have done to illustrate the effects of modern barriers in the dispersal of mammals. It is perhaps a little too strong, in the face of the lists which he gives, to state of the Straits of Gibraltar and the narrow passage opposite to Carthage that they are "faunistic boundaries of the first rank." The division between the arctic and the non-arctic parts of the palæarctic region are more easily defined from their mammalian indigenes.

Dr. Kobelt's book is closely packed with solid fact, and there is no more speculation than is necessary to give prominence to such generalisations as appear to him to be the legitimate outcome of his laboriously collected material. This has been amassed from the most diverse sources; and the author by no means disdains the older writers, even the ancients being laid under contribution. We commend the book to the serious student of zoogeography only, for it is emphatically not to be trifled with in an arm-chair.

F. E. B.

A TEXT-BOOK OF HEAT MOTORS.

The Steam Engine and Gas and Oil Engines. By John Perry, D.Sc., F.R.S. Pp. viii + 646. (London: Macmillan and Co., Ltd., 1899.)

THIS is one of the best books which has been published in this country on the steam engine and other heat motors. The method and style is thoroughly characteristic of Prof. Perry. Many will no doubt object to the order of arrangement of the various chapters, and

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will be inclined to think the author has put the cart before the horse; the author will probably reply that the book was not written for the beginner, but for advanced students.

There is something to be said for the plan adopted; if a text-book for students, engaged during the day in practical engine work, is given up in its early chapters almost entirely to the properties of steam and thermodynamic problems, there is great risk that the student will be discouraged and eventually give up the attempt to improve his knowledge of the principles underlying the working of heat motors.

The author's plan is to deal first with the more practical details, in the hope probably that in mastering these the student will find out what he lacks and what he needs of thermodynamics and kindred subjects. Granted this, it is still a little difficult to see that an improvement would not be effected by putting Chapters xv., xviii. and xix. on methods of calculation, on temperature and heat, and on the properties of steam, earlier in the book. This is shown by the necessity of a footnote on p. 99 to explain the way in which the total heat required in evaporating a pound of steam is determined.

Chapter ii. is devoted to description of cylinders, pistons, valves, frames, &c., of what the author calls the commonest form of steam engine, but as the details explained include parts of steam turbines, the title is hardly happy. The illustrations in this chapter are extremely good and complete.

Chapter iii. deals with the value of expansion, and the author points out, as a result of his calculations, that there are limits of economic expansion, and how easily the Willan's law can be deduced from such calculations.

Chapter iv. describes the indicator, its construction and the proper way to use it, and the errors it is liable to. Then, in the following chapter, come a most valuable series of exercises on calculations from indicator cards.

One of the chief merits of the book, apart from the fact that it is so thoroughly up to date in all its information and methods, is the way in which almost every chapter is filled with numerical exercises; any student genuinely working these out for himself cannot fail to become thoroughly master of the main problems confronting the student of heat motors.

In this chapter again (v.) we have a little awkwardness introduced from the particular arrangement adopted by the author. One of the exercises is the drawing of a $\theta\phi$ diagram, and no explanation of this has been given, the reader is referred for explanations to a much later chapter of the book. We fear the student is not likely to start with much knowledge of entropy, and will therefore probably skip these sections.

The next eight chapters are devoted to the mechanical details of valves, governors, air pumps, boilers and their fittings and accessories.

The first fourteen chapters may be said to mainly deal with the mechanical details of engines and boilers; while the rest of the book is devoted to what may be called theory and principle.

In Chapter xvi. the author deals with the cost of production of energy and the efficiency of various types of motors, a most complete and valuable chapter full of good examples. Then come some chapters on tem-

perature and heat, properties of steam, and work, &c., all very thorough and very full of matter for careful thought.

In the chapter on the $\theta\phi$ diagrams, more advanced theory is taken up; and, in fact, there are several chapters here that will be above the average student, and will form good reading for the expert; the facts are marshalled with great skill, and the deductions show that the author is a thorough master of his subject.

The chapters on valve motion problems and inertia of moving parts are good, and the methods adopted to deal with these very difficult problems are as simple as it is possible for them to be.

Though only forty-two pages are devoted to gas and oil engines, the author has managed to get in a great amount of most useful information, and to give all that the general student needs.

The remaining chapters are devoted to certain important thermodynamic problems and to an inquiry into the properties of superheated steam.

Most certainly Prof. Perry has produced a text-book which must be on the shelf of every student of applied thermodynamics, and of every engineer who has to deal with the utilisation of energy. H. B.

OUR BOOK SHELF.

Practical Plane and Solid Geometry for Advanced Students; including Graphic Statics. By J. Harrison, M.I.M.E., and G. A. Baxandall. Pp. xii + 558. (Macmillan and Co., 1889.)

THIS book appears to compare very favourably with most English works of its class. The greater part of it deals with practical solid geometry, including the method of indexed plans; this subject is treated in a much more methodical way than is usually the case, and the authors very properly call attention from time to time to constructions which are of a fundamental character. It is a pity they did not go further, and clearly distinguish throughout the book the worked examples which involve new points of theory from those which merely illustrate general constructions previously given. The directions for making cardboard models ought to be very useful to the student; and the constructions are explained in such a way as to make the reasons for them intelligible. The section on plane geometry is distinctly above the average; in particular, there is a very interesting discussion of the description of an ellipse by means of a paper trammel. Of graphical statics only a brief outline is given; but it is useful enough so far as it goes. There is one error to which attention ought to be drawn: on p. 342 it is stated that the tangent plane to a surface at an anticlastic point cuts the surface in a curve with a double point *where there are two inflexions*: this is not generally the case, and, in fact, the anchor-ring gives an example of the contrary. Here the section is a bicircular quartic which has a real ordinary node when the tangent plane cuts the ring, and is not parallel to the polar axis.

Grundlinien der maritimen Meteorologie. By W. Köppen. Pp. vi + 83. (Hamburg: G. W. Hiemeyer, 1899.)

THIS little work serves two purposes; it is practically a concise elementary meteorology, and a guide for the use of sailors, showing the best routes in the different oceans, with directions for the management of vessels in storms, especially the dangerous West India hurricanes and the typhoons of the China seas. Dr. Köppen has been known for many years as one of the most prominent meteorologists, and having access to the large amount of materials collected by the Deutsche Seewarte, we might

expect to find the result of his long experience embodied in a useful and an attractive form. The work meets our expectations in every way; all details which are unnecessary for the object in view have been carefully excluded, while all technical and nautical expressions are fully explained, so that the work, which is specially written for seamen, may be read with interest and advantage by all who are desirous of obtaining a knowledge of maritime meteorology. His treatment of the subject includes the general circulation of the atmosphere, as well as the movements of waves, tides and ocean currents, and the value of the treatise is much enhanced by explanatory figures in the text and by separate charts and diagrams.

Inorganic Chemical Preparations. By Felix Lengfeld. Pp. xviii + 57. (New York: The Macmillan Company. London: Macmillan and Co., Ltd., 1899.)

THIS is a compact series of instructions for the preparation of typical inorganic compounds, the selection of which seems to have been very judiciously made. References to original literature are given in connection with each preparation. The author takes care to explain "that the manual is merely a laboratory guide, and that unless the work is carefully supervised, it may become purely mechanical, and the course lose half its value." It is, in fact, a series of recipes, and no attempt is made to explain the innumerable difficulties that will confront the inexperienced worker. This is not said by way of complaint; on the contrary, it is the incidental and unexpected difficulties of an operation rather than the plain sailing that give the operator occasion to think, and lead to the close association of the teacher with the mind of the learner.

Mr. Lengfeld purposely refrains from giving a complete list of references to literature, being of opinion that the student should learn to use dictionaries of chemistry. It is doubtful, however, whether the student is able to make a discreet choice from the innumerable references of a dictionary, and we think that the author has rather lost an opportunity in not making his list of references more ample. To those teachers who are introducing more inorganic preparation work into their courses, this book is likely to prove welcome. A. S.

The Utility of Sulphate of Ammonia in Agriculture. By James Muir, M.R.A.C. Pp. 68. (London: Sulphate of Ammonia Committee, 4 Fenchurch Avenue, E.C., 1899.)

THIS is the essay which won the prize lately offered by the Sulphate of Ammonia Committee. Mr. Muir has carefully compiled his little treatise, and made a judicious selection of results of field experiments to illustrate the use of sulphate of ammonia, and to compare its results with those obtained from the use of nitrate of soda. Naturally, the results of the Rothamsted experiments are those most largely drawn upon; Woburn is also quoted from to a considerable extent, and the author considerably always gives references to his authorities. The comparisons between the effects of nitrate of soda and sulphate of ammonia are fully and very fairly drawn, and the farmer should find the essay a great help in deciding which of these nitrogenous manures to apply in any particular case. No doubt the farmer, for whom the essay is chiefly written, will turn to the last three pages, which contain a summary of conclusions and comparisons between the two important nitrogenous manures. This summary is in twenty-seven paragraphs, and but few of these lay themselves open to criticism. We can only suggest that the author might have pointed out more clearly in this summary, paragraph 3, that leguminous plants can, under favourable conditions, make use of free nitrogen; paragraph 7, that nitrogenous manures, and especially ammoniacal manures, do not give their best